Radiological National Emission Standards for Hazardous Air Pollutants (NESHAP) 2011 Annual Report for the Department of Energy Portsmouth Gaseous Diffusion Plant, Piketon, Ohio

U.S. Department of Energy
DOE/PPPO/03-0364&D1

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By
FBP LLC, a Joint Venture Under Contract DE-AC30-10CC40017

FBP-ER-GEN-WD-0053, Revision 1

The following certifications pertain to the U.S. Department of Energy (DOE) activities at the Portsmouth site. It is DOE's understanding that the United States Enrichment Corporation (USEC) will be submitting a separate Radiological National Emission Standards for Hazardous Air Pollutants (NESHAP) 2011 Annual Report and certification pertaining to its activities at the Portsmouth site.

DOE Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. See, 18 *U.S.C.* 1001.

Dr. Vincent Adams
Portsmouth Site Director
Portsmouth/Paducah Project Office
U.S. Department of Energy

6/26/12
Date

Fluor-B&W Portsmouth LLC Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. See, 18 *U.S.C.* 1001.

Woodrow "Jamie" Jameson
Program Manager
Fluor-B&W Portsmouth LLC (Operator)
(For information pertaining to Fluor-B&W Portsmouth LLC sources)

6/25/2012
Date

B&W Conversion Services, LLC Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. See, 18 *U.S.C.* 1001.

Michelle M. Reichert for

George E. Dials
President
B&W Conversion Services, LLC (Operator)
(For information pertaining to the DUF_6 conversion facility)

June 24, 2012
Date

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ACRONYMS

BWCS	B&W Conversion Services, LLC
CAP88-PC	Clean Air Assessment Package
CFR	Code of Federal Regulations
Ci	curie
DOE	U.S. Department of Energy
DUF_6	depleted uranium hexafluoride
FBP	Fluor-B&W Portsmouth LLC
HEPA	high efficiency particulate
HVAC	heating, ventilation, and air conditioning
MEI	maximally exposed individual
mrem	millirem
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
pCi	picocurie
PORTS	Portsmouth Gaseous Diffusion Plant
U_3O_8	triuranium octaoxide
USEC	United States Enrichment Corporation
U.S. EPA	U.S. Environmental Protection Agency

EXECUTIVE SUMMARY

This report provides the information required by Title 40 of the *Code of Federal Regulations (CFR)* Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H, National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy (DOE) Facilities.

DOE owns the Portsmouth Gaseous Diffusion Plant (PORTS) site, which has radionuclide air emissions from DOE operations. DOE leases a portion of the site to the United States Enrichment Corporation (USEC), whose operations also have radionuclide air emissions. DOE and USEC operations were included in the estimate of dose to the public for radionuclide emissions from the PORTS site; however, DOE certifies the information relating to its operations only.

At various times, USEC has returned some of the leased facilities to DOE. For some of these deleased facilities, DOE had contracted with USEC for operations and other work related to the PORTS gaseous diffusion facilities until FBP assumed responsibility. For this reporting period, DOE contracted with USEC to operate and maintain the deleased process buildings and feed complexes until March 29, 2011 when FBP assumed responsibility. Also in this reporting period, USEC deleased the "Balance of Plant" facilities (remaining deleased gaseous diffusion plant buildings) on September 30, 2011 and FBP assumed responsibility on that date. In addition to the deleasing activities related to USEC, the environmental remediation activities and waste management activities were transitioned from LATA/Parallax Portsmouth LLC to FBP on March 29, 2011 due to the end of their contract with DOE.

Uranium Disposition Services, LLC, operated the DUF_6 conversion facility from January 1, 2011 through March 28, 2011. B&W Conversion Services, LLC (BWCS) took over operations of the DUF_6 conversion facility on March 29, 2011. The conversion facility processes DUF_6 cylinders via a fluidized bed system to produce uranium oxide and salable hydrofluoric acid. This facility has one emission source, the conversion building stack.

Radionuclide emissions from the DOE sources are modeled by the Clean Air Assessment Package (CAP88-PC) Version 3.0 computer program [approved by the United States Environmental Protection Agency (U.S. EPA)] to estimate the effective dose to members of the public. Emissions from the DUF_6 conversion facility, X-326 Top Purge Cascade, X-326 and X-330 Seal Exhaust Stations, X-330 Cold Recovery System, X-330 Building Wet Air Evacuation System, X-344A Cold Trap Area and Gulper, X-705 Decontamination Facility, Calciners, Glove Boxes, and Storage Tank Vents, X-710 Laboratory Fume Hoods, XT-847 Glove Box, X-326 L-cage Glove Box and the X-622, X-623, X-624, and X-627 Groundwater Treatment Facilities were used to estimate the effective dose for 2011.

The effective dose to individuals based on USEC, Inc. emissions has been combined with the DOE PORTS effective dose. In 2011, the maximum effective dose for USEC, Inc. was 0.0000026 millirem (mrem)/year, as provided to DOE by USEC, Inc. DOE is certifying the effective dose for DOE activities only. DOE is not certifying the accuracy of the USEC, Inc. data, calculations, or results. DOE understands that the USEC, Inc. PORTS NESHAP report will be provided to U.S. EPA by USEC, Inc. and will be certified by USEC, Inc.

The effective dose from DOE sources at PORTS is combined with the USEC, Inc. effective dose to determine a total effective dose from the PORTS facility. The highest combined effective dose is the maximum effective dose to the maximally exposed individual (MEI) who is a member of the public. In 2011, the maximum combined effective dose to the MEI was 0.032 mrem/year (0.032 mrem/year from DOE sources + 0.0000017 mrem/year from the same individual USEC, Inc. source), which is well below the NESHAP standard of 10 mrem/year.

DOE collects samples from 15 ambient air monitoring stations located on and near the PORTS reservation and analyzes them for the radionuclides that could be present in ambient air due to PORTS activities. These radionuclides are isotopic uranium (uranium-233/234, uranium-235, uranium-236, and uranium-238), technetium-99, and selected transuranic isotopes (americium-241, neptunium-237, plutonium-238, and plutonium-239/240). The ambient air monitoring stations measure radionuclides released from the DOE and USEC, Inc. point sources, fugitive air emissions, and background concentrations of radionuclides.

The CAP88-PC model was used to generate a dose conversion factor that was used to calculate a dose (in mrem/year) for a given activity of each radionuclide in air (in picocuries per cubic meter). A dose was computed for each ambient air monitoring station. The net dose for each ambient air monitoring station (subtracting the dose measured at the background station) ranged from 0 (at stations with a gross dose less than the background station) to 0.0012 mrem/year. The highest net dose measured at the ambient air monitoring stations is four percent of the dose calculated from the combined DOE and USEC, Inc. point source emissions (0.032 mrem/year). These results indicate that fugitive emissions of radionuclides from the PORTS reservation do not cause a significant dose to individuals near the site and further demonstrate that emissions of radionuclides from PORTS are well within NESHAP limits.

1. FACILITY INFORMATION

1.1 SITE DESCRIPTION

The Portsmouth Gaseous Diffusion Plant (PORTS) in Piketon, Ohio, began uranium enrichment operations using the gaseous diffusion process in 1954. In 1993, the U.S. Department of Energy (DOE) leased the uranium enrichment production and operations facilities at PORTS to the United States Enrichment Corporation (USEC). USEC enriched uranium at PORTS for use in commercial nuclear power reactors until May 2001.

DOE owns the PORTS site, which has radionuclide air emissions from DOE operations. DOE leases a portion of the site to USEC, whose operations also have radionuclide air emissions. DOE and USEC operations were included in the estimate of dose to the public for radionuclide emissions from the PORTS site; however, DOE certifies the information relating to its operations only.

At various times, USEC has returned some of the leased facilities to DOE. For some of these deleased facilities, DOE had contracted with USEC for operations and other work related to the PORTS gaseous diffusion facilities until FBP assumed responsibility. For this reporting period, DOE contracted with USEC to operate and maintain the deleased process buildings and feed complexes until March 29, 2011 when FBP assumed responsibility. Also in this reporting period, USEC deleased the "Balance of Plant" facilities (remaining deleased gaseous diffusion plant buildings) on September 30, 2011 and FBP assumed responsibility on that date. In addition to the deleasing activities related to USEC, the environmental remediation activities and waste management activities were transitioned from LATA/Parallax Portsmouth LLC to FBP on March 29, 2011 due to the end of their contract with DOE.

USEC, Inc. (the parent company of USEC) is currently developing centrifuge enrichment technology at PORTS, including construction of both a small-scale demonstration facility (the Lead Cascade Test Facility) and a commercial-scale uranium enrichment facility (the ACP).

This report covers only the DOE operations at PORTS. The Depleted Uranium Hexafluoride (DUF_6) conversion facility was built for DOE at PORTS to process DUF_6 produced by the gaseous diffusion process. DUF_6, which is stored in cylinders, is removed from the cylinders and converted to uranium oxide, which will be made available for beneficial reuse, storage, and/or disposal.

1.2 SOURCE DESCRIPTION

DOE is responsible for the following stack sources regulated by the U.S. Environmental Protection Agency (U.S. EPA) under the National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H: the DUF_6 conversion facility, X-326 Top Purge Cascade, X-326 and X-330 Seal Exhaust Stations, X-330 Cold Recovery System, X-330 Building Wet Air Evacuation System, X-344A Cold Trap Area and Manifold Evacuation/Gulper, X-705 Decontamination Facility, Calciners, Glove Boxes, and Storage Tank Vents, X-710 Laboratory Fume Hoods, X-700 Cleaning Building, X-720 Maintenenace Facility, XT-847 Glove Box, X-326 L-cage Glove Box, X-622 Groundwater Treatment Facility, X-623 Groundwater Treatment Facility, X-624 Groundwater Treatment Facility, and X-627 Groundwater Treatment Facility.[1]

1.2.1 MONITORED SOURCES

Sixteen sources associated with the former gaseous diffusion plant and related operations are equipped with continuous emissions samplers. In accordance with 40 CFR 61.93(b)(4)(i), these sources were

[1]The point sources in the "Balance of Plant" (X-705, X-710, X-700, X-720, and XT-847 buildings) were deleased from USEC on September 30, 2011.

identified as having potential emissions of radionuclides which could cause an effective dose equivalent greater than 1% of the standard (10 mrem/yr). Ten samplers operated during 2011. All ten monitored sources are sampled continuously when operating by flow-proportional, isokinetic samplers to provide emissions data. These monitored sources are listed in Table 1 and described in the following paragraphs.

Table 1. PORTS Monitored Emission Points

Location	Vent Identification Number
X-326 Top Purge Vent	X-326-P-2799
X-326 Side Purge Vent (inactive)	X-326-P-2798
X-326 Emergency Jet Vent	X-326-P-616
X-326 Seal Exhaust Vent 6	X-326-A-540
X-326 Seal Exhaust Vent 5	X-326-A-528
X-326 Seal Exhaust Vent 4	X-326-A-512
X-330 Seal Exhaust Vent 3	X-330-A-279
X-330 Seal Exhaust Vent 2 (inactive)	X-330-A-262
X-333 Seal Exhaust Vent 1 (inactive)	X-333-A-851
X-330 Cold Recovery/Building Wet Air Evacuation Vent	X-330-A-272
X-333 Cold Recovery Vent (inactive)	X-333-P-852
X-333 Building Wet Air Evacuation Vent (inactive)	X-333-P-856
X-343 Cold Trap Vent (inactive)	X-343-P-468
X-344A Gulper Vent	X-344-P-929
X-344A Cold Trap Vent	X-344-P-469
DUF_6 Conversion Building Stack	X-1700-001

X-326 Top and Side Purge Cascades

The two purge cascades continuously separate light gases from process gas (UF_6) using gaseous diffusion. The separated process gas is returned to the operating cascade cells from the purge cascade. The light gases are split at the head of the purge cascades with enough "lights" being recycled to maintain normal operating flows and the balance being vented through chemical adsorbent traps to the atmosphere. For operational control, each of the two purge cascades is monitored separately with real-time instruments called "space recorders".

Operation of the purge cascade(s) is required for continued operation of the main process cascade. Consequently, the two purge cascades are exhausted by three interconnected air jet eductors. The third eductor (the E-Jet) is an operating spare for either or both regular eductors. The eductors are interconnected to a set of four exhaust pipes. The pipes extend up a 50-meter freestanding tower to remove the emissions from the X-326 Process Building's wind wake. For compliance purposes, each of the three eductors is fitted with separate continuous samplers.

The Top Purge Cascade continues to operate to support the in-situ deposit removal activities. The Side Purge Cascade is in standby with its associated eductor valved off. The E-Jet has continued to operate as needed. Both purge cascades and all three eductors remain available for use if needed.

Seal Exhaust Stations

The seal exhaust (SE) stations maintain a vacuum within cascade compressor shaft seals to prevent inleakage of wet air to the cascade. This vacuum is isolated from the compressor side of the seal by a buffer zone. Gases evacuated from the seals are pulled through chemical adsorbent traps by a bank of manifolded vacuum pumps and exhausted to the atmosphere through mist eliminators (for pump oil) and a roof vent. There is one seal exhaust station in each of the cascade's six "process areas" in the X-326, X-330, and X-333 buildings, each being located adjacent to the area control room (ACR).

Two of the seal exhaust stations (Areas 1 and 2) have been shut down. The rest of the seal exhaust stations continue to operate to support the in-situ deposit removal activities. All of the seal exhaust stations are available for use if needed.

Cold Recovery Systems

The cold recovery systems are intermittently operated maintenance support systems used to prepare cascade equipment (e.g., cells) for internal maintenance. Process gas in cascade cells scheduled for maintenance is first evacuated to adjacent cascade cells to the extent practical. The cell is then isolated and alternately purged with dry nitrogen and evacuated to the Cold Recovery System. The evacuated gases pass through chilled vessels called "cold traps" to solidify any residual process gas. The non-condensable nitrogen carrier is passed through chemical adsorbents for polishing and then is vented to the atmosphere. Periodically, individual cold traps are valved off from the vent, and the trapped UF_6 is returned to the cascade by vaporization. There are two cold recovery systems operated at PORTS with one each in the X-330 and X-333 Process Buildings. In X-330, the cold recovery system shares a common vent and vent sampler with the building wet air evacuation system.

Only the X-330 Cold Recovery System continues to operate as needed to support the in-situ deposit removal activities. However, the X-330 Cold Recovery System has not been in use since May, 2010. Both of the Cold Recovery Systems are available for use if needed.

Building Wet Air Evacuation Systems

The building wet air evacuation systems are intermittently operated maintenance support systems used to prepare off-line cascade cells for return to service. The cell is alternately purged with dry nitrogen and evacuated to remove air and moisture from the cell. The evacuated gases are passed through chemical adsorbents to catch residual radionuclides (if any) and vented to the atmosphere. There are two building wet air evacuation systems, one associated with each of the cold recovery systems described above for the X-330 and X-333 buildings. In X-330, the cold recovery and building wet air evacuation systems share a common vent and sampler.

Only the X-330 Building Wet Air Evacuation System continues to operate to support the in-situ deposit removal activities. This system shares a common vent with the X-330 Cold Recovery System. Both of the Building Wet Air Evacuation Systems are available for use if needed.

X-343 and X-344A Cold Trap Areas

Under PORTS' historic configuration, autoclaves in the X-343 facility vaporized UF_6 in 14-ton cylinders to provide feed material for the enrichment cascade. Autoclaves in the X-344A facility liquefied enriched UF_6 in 14-ton or 10-ton cylinders for quality control sampling and transfer to 2.5-ton cylinders for shipment to customers. Residual gases evacuated from the autoclave process piping were returned to the cascade.

To deal with the residual gases without an operating enrichment cascade, cold trap systems similar to those in the cascade cold recovery areas were refurbished and upgraded in both facilities. (The cold trap systems were part of the original design of both facilities, but were taken out of service after the piping evacuation systems were redirected back to the cascade.) As part of the upgrades, both systems received new continuous vent samplers based on the continuous vent samplers used on other vents at PORTS. The new samplers are equipped with radiation monitors to track the accumulation of radioactive material in the sampler traps in real-time. This replaces the 1950's-style "space recorders" used for operational control of older monitored vents at PORTS.

In 2011, the X-343 was in a cold shutdown condition. There are no current plans to restart any of the autoclave operations in the building. The X-344A facility was in operation during 2011.

X-344A Gulper Vent

The X-344A UF_6 Sampling Building contains a sampling and transfer system for sampling the product and for filling customer cylinders with low assay UF_6. The term "assay" refers to the concentration of ^{235}U in weight percent. To avoid cross contamination between samples and to prevent emissions to the air, the sampling and transfer manifold was formerly evacuated back to the diffusion cascade through a line to the X-342 Feed Vaporization and Fluorine Generation Building and, since May 2001, to the X-344A Cold Trap System. In the event of a trace release occurring in spite of the purge and evacuation procedure, a "gulper" is mounted behind the manifold-to-cylinder connections. The gulper is simply a continuous vacuum nozzle, similar in principal to a lab hood, which draws any small releases from the room air into a filtration system. The filtration system has two filter banks, each consisting of a roughing filter followed by high efficiency particulate air (HEPA) filters and a centrifugal blower.

DUF_6 Conversion Facility

The DUF_6 conversion facility produces uranium oxide dust that is primarily in the form of triuranium octaoxide (U_3O_8). Multiple prefilters and primary HEPA filter banks within the facility heating, ventilation, and air conditioning (HVAC) system control particulate emissions of oxide powder. Prior to atmospheric venting of process off gas through the stack, air passes through a secondary set of HEPA filter banks. The conversion building is also maintained at negative pressure to help eliminate the possibility of fugitive emissions.

1.2.2 UNMONITORED SOURCES

PORTS has a number of unmonitored and potential emission sources associated with process support activities and groundwater treatment. These unmonitored sources are point sources that have the potential to emit radionuclides that produce a dose less than or equal to 0.1 mrem. Emissions from these sources are evaluated in accordance with 40 *CFR* 61.93(b)(4)(i), which states: *For other release points which have a potential to release radionuclides into the air, periodic confirmatory measurements shall be made to verify the low emissions.*

The potential sources are primarily room ventilation exhausts and/or pressure relief vents from areas that have a potential for an internal radionuclide release.

Emission estimates for the X-705 Decontamination Facility, X-705 Calciners, X-705 Glove Boxes, X-705 Storage Tank Vents, Laboratory Fume Hoods, and XT-847 Glove Box, are based on 2010 operational levels and are updated every five years. The estimates for these sources are based on the methodology in

Appendix D of 40 CFR 61. Emissions for the other unmonitored sources are determined as described in Section 2.1.2.

X-705 Decontamination Facility

Equipment that is removed from the PORTS cascade is covered at the point of removal and transported to the X-705 Decontamination Facility. Small parts may be cleaned in hand tables, while large parts may be sent through an automated tunnel. The hand tables consist of shallow acid baths where metal parts can be decontaminated by passive soaking. The hand tables have fume hoods over them to protect workers from acid fumes. Pressure relief vents are standard on such equipment. The tunnel is an enclosed series of "booths" that can decontaminate large parts by spraying with decontamination solutions as a small dolly carries the parts through the tunnel. The tunnel is ventilated to prevent a buildup of acid fumes. In all cases, radionuclides (uranium and technetium) are dissolved in the liquid phase and collected for recovery of the uranium. None of the radionuclides are volatilized through normal operation of these facilities and only trace radionuclides carried by entrained droplets would be expected.

X-705 Calciners

Solutions are processed in the Uranium Recovery Area to yield a concentrated uranyl nitrate solution, which is converted into uranium oxide powder in one of two calciners located in X-705. A calciner consists of an inclined heated tube with the uranyl nitrate solution entering at the top and air entering at the bottom. The uranium is first dried and then oxidized as it passes down the tube. The uranium oxide powder is collected directly into a five-inch diameter storage can at the lower end of the calciner tube. The gaseous stream leaves the upper end of the calciner and is exhausted through a scrubber for NO_x control. Uranium is recovered from the spent scrubber solution through a microfiltration process and the effluent is discharged to a National Pollutant Discharge Elimination System permitted outfall. Turbulence and flow rates through the calciners are controlled to minimize blowback of the uranium oxide. Any blowback that does occur is entrapped by the entering uranium solution.

X-705 Glove Boxes

The five-inch can that collects the uranium oxide powder from each calciner is housed in a glove box to prevent the loss of the material. In addition, there is a separate glove box which is used for sampling the material in the can. The glove boxes have air locks for the entry and removal of work materials and are maintained under negative pressure during use. This negative pressure is produced by an exhaust fan drawing through a HEPA filter.

X-705 Storage Tank Vents

Uranium-bearing solutions awaiting treatment are stored in five-inch diameter tanks inside the X-705 facility. All of these tanks are manifolded to a common pressure relief vent that has some potential to release radionuclides if the tanks are overfilled or overheated. Normal emissions should be zero since the stored liquids are quiescent, the dissolved radionuclides are non-volatile, and the vents are not open except during filling.

Laboratory Fume Hoods

Laboratory analysis of process and other samples is performed in the PORTS on-site laboratory in accordance with standard laboratory practices. There are no emissions controls on the lab hoods used in these procedures. The hoods should not exhibit any measurable radionuclide emissions during normal operation. Small amounts of technetium are partially volatilized by the analytical method approved by the Environmental Protection Agency under the Safe Drinking Water Act. There is also a possibility of a UF_6 sample container bursting during processing. This is an extremely rare occurrence, however, and cannot be regarded as normal operation as specified in the NESHAP regulations. Most laboratory fume hoods are located in the X-710 Laboratory. The X-705 Decontamination Facility also has a small laboratory which contains three fume hoods which were used to prepare samples and analyze materials being processed in the building. This laboratory has been out of service for several years.

The X-710 Laboratory is in routine use. Consequently, emission estimates were included in the source term for the dose modeling using CAP88. The emissions from the X-710 were modeled as a single source.

XT-847 Glove Box

The XT-847 Glove Box is a large stainless steel glove box which is used to batch small quantities of radioactively contaminated waste for more efficient and less costly storage, shipment, and disposal. The primary waste stream involved is spent alumina and other adsorbents used in control traps on process vents. When the adsorbent is removed from use, it is placed in a safe geometry container (5", 8" or 12" diameter, depending on assay). The material is then analyzed, and if the uranium content meets nuclear criticality safety limits, it is batched into larger containers including, but not limited to, 55 gallon drums. Other radiological materials may also be handled in the glove box. The XT-847 Glove Box exhausts through a HEPA filter and is normally in routine use. However, the Glove Box was not operational in 2010 due to maintenance issues, when the emissions estimates were last required to be updated.

X-326 L-cage Glove Box

The X-326 L-cage Glove Box has airlocks for the entry and removal of work materials and is maintained under negative pressure during use. This negative pressure is produced by an exhaust fan drawing air through a high-efficiency particulate (HEPA) filter. Effluent control is provided by the HEPA filter; calculations of emissions from the glovebox assume a HEPA filter control factor of 0.01 (99 percent efficiency) as provided in Title 40 of the *Code of Federal Regulations (CFR)*, Part 61, Appendix D. Materials contaminated with radionuclides are sampled, batched, blended, or repackaged in the Glove Box and generate low emissions of radionuclides. Twenty-five containers were batched in this Glove Box during 2011.

X-622, X-623, X-624, and X-627 Groundwater Treatment Facilities

The X-622, X-623, X-624, and X-627 Groundwater Treatment Facilities treat groundwater contaminated with volatile organic compounds and radionuclides and release treated water through permitted National Pollutant Discharge Elimination System (NPDES) outfalls. To reduce air emissions of volatile organic compounds from the groundwater treatment facilities, a de-mister is installed on the air stripper at X-622, and off-gas carbon units are installed on the air strippers at the X-623, X-624, and X-627 facilities. The clarifier at the X-622 Groundwater Treatment Facility is part of the treatment process and is vented to the environment. No control equipment is installed on the clarifier. No control equipment is installed at any of the groundwater treatment facilities to reduce emissions of radionuclides.

X-735 Landfill

The current Permit-to-Install and Operate for the venting system at the X-735 Landfill, issued by the Ohio Environmental Protection Agency, includes a requirement for compliance with NESHAP Subparts A (General Provisions) and H (National Emission Standards for Emissions of Radionuclides Other Than Radon from DOE Facilities), although the NESHAP provisions are administered directly by U.S. EPA.

The results of air emissions testing of the X-735 Landfill venting system, performed from September 25 through September 29, 1995, were used to calculate radionuclide emissions from the landfill. During the testing, samples were collected from a uniform pattern of 16 of the 33 landfill vents and analyzed for gross alpha activity and gross beta activity. Alpha activity was not detected in any of the samples. Beta activity was detected in 1 of the 16 samples at one picocurie (pCi)/sample, which was just above the analytical detection limit of 0.9 pCi/sample.

In the *Performance Test Report X-735 Landfill Closure (Northern Portion) Cap Construction and Gas Venting System* (DOE 1995), the average beta activity per cubic meter per vent was calculated using the conservative assumption that beta activity was being emitted at half the detection limit in the 15 vents in which beta activity was undetected. Emissions of beta activity for all 33 vents were calculated as 0.00213 pCi/min (DOE 1995).

For compliance with NESHAP Subpart H regulations, beta emissions were conservatively assumed to be technetium-99, the only radionuclide associated with PORTS activities that is a beta emitter (the transuranics and uranium isotopes associated with PORTS are alpha emitters). Because alpha activity was not detected in the emissions testing, it is not included in the dose assessment. The annual emission rate of 0.0000000011 (1.1E-09) curie (Ci)/year of technetium-99 results in a dose of 0.00000000067 (6.7E-10) millirem (mrem)/year to an individual 250 meters north of the X-735 Landfill at the PORTS property boundary. Because the dose from the X-735 Landfill venting system is more than one million times smaller than the doses from the groundwater treatment facilities and more than one billion times smaller than the regulatory limit of 10 mrem/year, the X-735 Landfill venting system is not a major contributor to the DOE dose and will not be discussed in the remainder of this report.

2. RADIONUCLIDE EMISSIONS

Section 2.1 discusses the methods used to calculate radionuclide emissions from each of the DOE sources that emitted radionuclides during 2011. Table 2 presents a summary of the radionuclide emissions from DOE sources in 2011.

Table 2. Emissions (Ci/year) from DOE Air Emission Sources in 2011

Radionuclide	X-622	X-623	X-624	X-627	X-326[b]	DUF_6 facility
Americium-241	2.2E-07	0	2.3E-07	1.3E-07	0	-
Neptunium-237	5.2E-08	2.9E-08	1.2E-08	3.1E-08	0	-
Plutonium-238	0	5.0E-08	1.9E-08	0	0	-
Plutonium-239/240[a]	3.0E-07	2.0E-07	2.5E-07	0	0	-
Technetium-99	7.7E-03	1.3E-03	2.4E-05	8.4E-03	2.9E-07	-
Uranium-233/234[a]	6.1E-06	2.7E-05	1.9E-06	0	6.6E-08	1.2E-06
Uranium-235	2.2E-07	1.0E-06	5.0E-08	0	6.3E-09	5.5E-08
Uranium-236	4.3E-07	3.4E-07	2.5E-08	6.1E-08	0	-
Uranium-238	3.1E-06	6.6E-06	8.1E-07	0	6.6E-08	2.9E-06
Total	7.7E-03	1.4E-03	2.8E-05	8.4E-03	4.3E-07	2.4E-08

Radionuclide	Group 1[c]	Group 2[d]	Group 3[e]
Uranium-234	3.29E-03	6.16E-06	4.48E-03
Uranium-235	1.40E-04	2.06E-6	1.92E-04
Uranium-238	6.37E-04	3.62E-06	6.21E-04
Technetium-99	5.15E-03	1.50E-03	4.28E-03
Thorium-228	3.74E-08	8.61E-07	3.39E-10
Thorium-230	3.75E-08	3.71E-06	3.40E-10
Thorium-231	1.40E-04	2.06E-06	1.92E-04
Thorium-232	2.29E-09	7.29E-09	2.07E-11
Thorium-234	6.37E-04	3.62E-06	6.21E-04
Protactinium-234m	6.37E-04	3.62E-06	6.21E-04
Total	1.06E-02	1.53E-03	1.10E-02

[a]Plutonium-239/240 is entered as plutonium-239 and uranium-233/234 is entered as uranium-234 in the CAP88-PC model.
[b]This includes only the X-326 Glove Box
[c]Group 1 consists of Source 1 (X326 Top Purge and Emergency Jet Vents), Source 2 (X-326 Seal Exhaust Vents), Source 8 (X-710 vents) and Source 10 (XT-847 Glove Box)
[d]Group 2 consists of Source 5 (X-344A Gulper Vent) and Source 12 (X-344A Cold Trap Vent)
[e]Group 3 consists of Source 3 (X-330 Vents), Source 4 (X-333 Vents), Source 6 (X-700 Vents), and Source 7 (X-705 Vents)

Table 3 lists the distances from the DOE air emission sources to the nearest public receptors as required by 40 CFR Section 61.94(b)(6).

Table 3. Distances to Nearest Public Receptors from DOE Sources

Source	Distance in meters to the nearest public receptors					
	Resident	School	Office/ Business	Farm		
				Crops/Vegetables	Meat	Milk
DUF_6 facility	1329 W	4320 N	988 WNW	2033 W	1609 W	3900 NNE
X-326[a]	1383 E	4999 NNW	1677 WNW	2185 WSW	1671 WSW	4498 N
X-622	1040 SE	5392 NNW	1293 SSE	2184 WSW	1495 SSE	4804 N
X-623	838 ESE	4264 NNW	2286 W	2800 SSE	1037 E	3505 NNW
X-624	579 ESE	4294 NNW	2652 W	2776 SSE	525 ESE	3353 NNW
X-627	1377 ESE	4118 NNW	5421 W	2654 W	1495 E	3439 N

[a]This includes only the X-326 Glove Box

2.1 POINT SOURCES

2.1.1 PROCESS VENTS

Table 4 shows the grouping of vents for modeling (discussed below). Table 5 presents a summary of source term emissions for 2011. Table 6 and Table 7 summarize the control device information for each source and give the distance and direction from each source to the nearest resident, school, office or business, and vegetable, meat, and milk-producing farms.

The CAP88 model allows up to six sources to be modeled at one time, but assumes that all sources are located at the origin of the same circular grid. Since 2001, the former USEC sources have been grouped into three different source groups for the purposes of modeling. These source groups are as follows.

Group 1 includes the X-326 Stack, all other X-326 vents, all X-710 Laboratory vents and the XT-847 Glove Box Exhaust; these sources were modeled from the location of the X-326 Stack. The XT-847 Glove Box Exhaust had no radioactive emissions for 2011. Group 2 includes only the two X-344A vents; modeled from the location of X-344A Cold Trap Vent. Group 3 includes the X-330, X-333, X-343, X-700, X-705, and X-720 building vents; modeled from the middle of the X-705 Building. Four of the six buildings in Group 3; X-333, X-343, X-700 and X-720; had no active radioactive emission sources during 2011.

Table 4. Grouping of Vents for Modeling

Source	Consists of	Modeled with Source
1	X-326 Top Purge Vent, Side Purge Vent and Emergency Jet Vent	1
2	X-326 SE 6 Vent, SE 5 Vent, SE 4 Vent and ventilation exhaust	1
3	X-330 Building Cell Evacuation/Cold Recovery Vent, SE 3 Vent, SE 2 Vent and ventilation exhaust	7
4	X-333 Cold Recovery Vent, Building Wet Air Evacuation Vent, SE 1 Vent and ventilation exhaust (inactive)	7
5	X-344A Gulper Vent	5
6	All X-700 vents (inactive)	7
7	All X-705 vents	7
8	All X-710 vents	1
9	All X-720 vents (inactive)	7
10	XT-847 Glove Box Vent (inactive)	1
11	X-343 Cold Trap Vent (inactive)	7
12	X-344A Cold Trap Vent	5

Table 5. Emissions (in Curies) During CY 2011

NUCLIDE	Process Vent Sources												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
^{234}U	3.23E-03	5.94E-05	3.88E-06	0	2.06E-06	0	4.47E-03	6.75E-06	0	0	0	4.10E-06	7.78E-03
^{235}U	1.29E-04	3.84E-06	6.07E-07	0	8.76E-07	0	1.91E-04	6.88E-06	0	0	0	1.19E-06	3.34E-04
^{238}U	5.99E-04	6.51E-06	8.55E-07	0	1.49E-06	0	6.20E-04	3.19E-05	0	0	0	2.13E-06	1.26E-03
^{99}Tc	2.13E-03	3.02E-03	4.12E-03	0	5.80E-04	0	1.59E-04	8.51E-06	0	0	0	9.21E-04	1.09E-02
^{228}Th	0	0	0	0	8.02E-07	0	3.39E-10	3.74E-08	0	0	0	5.91E-08	8.99E-07
^{230}Th	0	0	0	0	3.45E-06	0	3.40E-10	3.75E-08	0	0	0	2.62E-07	3.75E-06
^{231}Th	1.29E-04	3.84E-06	6.07E-07	0	8.76E-07	0	1.91E-04	6.88E-06	0	0	0	1.19E-06	3.34E-04
^{232}Th	0	0	0	0	0	0	2.07E-11	2.29E-09	0	0	0	7.29E-09	9.60E-09
^{234}Th	5.99E-04	6.51E-06	8.55E-07	0	1.49E-06	0	6.20E-04	3.19E-05	0	0	0	2.13E-06	1.26E-03
^{234m}Pa	5.99E-04	6.51E-06	8.55E-07	0	1.49E-06	0	6.20E-04	3.19E-05	0	0	0	2.13E-06	1.26E-03

Notes:

1. Sources 4, 6, 9, 10 and 11 (X-333, X-700, X-720, XT-847 & X-343) were inactive for radionuclide operations in 2011.

Table 6. Process Vent Sources

Point Source[a]	Control Device	Control Efficiency	Distance in Meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Milk	Meat	Veg.
X-326 Top Purge, Side Purge & E-jet (Cascades) (3 monitors)[b]	Chemical Adsorbents	0-95%[c]	1370 SE	5000 NNW	1520 SSE	4290 N	1370 E	8660 ENE
X-330 Cold Recovery/Wet Air Evacuation Vent	Cold Traps Chemical Adsorbents	90-95%[d] 0-95%[c]	1690 ESE	3930 NNW	1370 W	3200 N	1520 ESE, W	8380 ENE
X-333 Cold Recovery Vent	Cold Traps Chemical Adsorbents	90-95%[d] 0-95%[c]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE
X-333 Wet Air Evacuation Vent	Chemical Adsorbents	0-95%[c]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE
X-326 Seal Exhaust Area 6	Chemical Adsorbents	0-95%[c]	1430 E	4880 NNW	1620 SSE	4180 N	1340 E	8630 ENE
X-326 Seal Exhaust Area 5	Chemical Adsorbents	0-95%[c]	1460 E	4630 NNW	1540 WNW	3940 N	1340 E	5830 ENE
X-326 Seal Exhaust Area 4	Chemical Adsorbents	0-95%[c]	1500 ESE	4420 NNW	1460 WNW	3720 N	1340 E	8470 ENE

See notes on page 15.

Table 6. Process Vent Sources, continued

Point Source[a]	Control Device	Control Efficiency	Distance in Meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Milk	Meat	Veg.
X-330 Seal Exhaust Area 3	Chemical Adsorbents	0-95%[c]	1620 E	4080 NNW	1400 W	3360 N	1430 E	8400 ENE
X-330 Seal Exhaust Area 2	Chemical Adsorbents	0-95%[c]	1725 ESE	3690 NNW	1430 WSW	3020 N	1580 SE, W	8320 ENE
X-333 Seal Exhaust Area 1	Chemical Adsorbents	0-95%[c]	1330 ESE	3840 NNW	1860 WSW	2960 N	1230 SE	7890 ENE
X-343 Cold Trap Vent	Cold Traps Chemical Adsorbents	90-95%[d] 0-95%[c]	1070 ESE	3980 NW	2130 WSW	2980 N	1040 SSE	7620 ENE
X-344A Gulper Vent	HEPA Filters	99.97%	1830 ESE	3410 NNW	1460 WSW	2680 N	1830 SSE	8320 ENE
X-344A Cold Trap Vent	Cold Traps Chemical Adsorbents	90-95%[d] 0-95%[c]	1870 ESE	3380 NNW	1440 WSW	2660 N	1860 SSE	8340 ENE
XT-847 Glove Box	HEPA Filters	99.97%	640 SSW	5840 N	980 SE	5150 N	1300 S	9150 ENE

See notes on page 15.

Table 7 Grouped Sources

Point Source[a]	Control Device	Control Efficiency	Distance in Meters to the Nearest:					
			Resident	School	Office or Business	Farm		
						Milk	Meat	Veg.
X-705 Calciners (3)	Wet Scrubber	75%[e]	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-710 Laboratory Fume Hoods (39)	None	N/A	1260 E	4690 NNW	1660 WNW	3930 N	1130 E	8350 ENE
X-705 Decontamination Facility	One area HEPA Others none	99.97% N/A	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-705 Storage Tank Vents	None	N/A	1330 ESE	4020 NNW	1800 W	3200 N	1050 ESE	7960 ENE
X-700 Cleaning Building	HEPA Filters	99.97%	1220 ESE	3910 NNW	1910 W	3200 N	930 E	7840 ENE
X-720 Maintenance Facility	None	N/A	1220 E	4250 NNW	1800 W	3430 N	1010 E	7880 ENE
Room Air Exhausts	None	N/A	850 ESE	3410 NNW	1370 W	2680 N	760 SE	7560 ENE

See notes on page 15.

Notes to Tables in Section 2.0

a.	All sources in Table 2.0 have continuous vent monitors except the XT-847 Glove Box.
b.	The Top and Side Purge Cascade vent streams pass separately through activated alumina traps. A third line, the Emergency Jet, connects to both lines through block valves. All three lines have continuous samplers. The three vent lines connect to four exhaust pipes that extend above the 50-meter tower. The Top Purge jet is vented directly through one pipe. The Side Purge Jet and Emergency Jet lines are interconnected to the other three pipes.
c.	Chemical adsorbents (such as activated alumina and sodium fluoride) are approximately 95 percent effective at concentrations above 1 ppm. Below this concentration, chemical adsorbents have reduced efficiency or no effect. Normal concentrations entering the Purge Cascade Chemical Traps are near or below 1 ppm. The sample traps (which follow the control traps) use activated alumina hydrated to 14 percent moisture content, which is much more effective due to an instantaneous reaction of gaseous UF6 and 99Tc with the water to form particulate matter.
d.	Based on process knowledge, cold traps are estimated to be approximately 90 to 95 percent effective in trapping gaseous UF6.
e.	Scrubber efficiency is estimated to be approximately 75 percent but has not been rigorously measured. Normal emissions from the source are estimated to be negligible compared to monitored sources (<0.001 curies of uranium).

2.1.2 OTHER POINT SOURCES

Emissions from the X-622, X-623, X-624, and X-627 Groundwater Treatment Facilities were calculated based on quarterly influent and effluent sampling at each facility, and quarterly throughput. The activity measured in the effluent sample was subtracted from the influent sample; the difference is assumed to have been emitted from the facility. As a conservative measure, radionuclides that were not detected in the samples were assumed to be present at half the undetected result.

Emissions from the X-326 L-cage Glovebox were based on the mass of the materials transferred within the glovebox, analytical data available on each material for radionuclides identified for air monitoring at PORTS (americium-241, neptunium-237, plutonium-238, plutonium-239/240, technetium-99, uranium-233/234, uranium-235, uranium-236, and uranium-238), and emission factors provided in 40 CFR Part 61 Appendix D.

Emissions from the DUF_6 conversion facility were provided by BWCS. Emissions were based on one year of operation with limited production.

Emissions from the X-326, X-330, and X-344A process vents were calculated based on weekly sample trap results for technetium-99, uranium-233/234, uranium-235, uranium-238, thorium-228, thorium-230, and thorium-232. Emissions from the X-705 vents, X-710 vents, and X-720 vents were based on mass of materials processed and emission factors provided in 40 CFR Part 61 Appendix D.

Table 2 and Table 5 identify the emissions from these sources for 2011.

2.2 FUGITIVE AND DIFFUSE SOURCES

Fugitive and diffuse emissions include all emissions that do not pass through a discrete stack, vent, or pipe. Potential emissions of diffuse and fugitive emissions at PORTS include normal building ventilation, soil and groundwater remediation sites, and wastewater treatment facilities.

Ambient air monitors are used at PORTS to confirm that radiological emissions from the site produce a dose much less than the level allowed by regulations. The ambient air monitors are divided into three groups: on site, property line, and off site. One monitor is located 13 miles southwest of the facility to measure background levels of radionuclides. Quality Assurance for the ambient air monitors is maintained through the *Sampling, Analysis and Quality Assurance Plan for the Portsmouth Gaseous Diffusion Plant Ambient Air Monitoring Program* (LPP-0086.)

Samples are collected weekly from the monitoring stations. Samples are then composited into a monthly sample and analyzed for radionuclides representative of PORTS operations. Analyses for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240) are performed quarterly based on the infrequent detections of these radionuclides. Analyses of technetium-99, uranium-233/234, uranium-235, uranium-236, and uranium-238 are performed monthly. Section 4.3, Table 11, provides a dose estimate for each ambient air monitoring station based on the results of this ambient air sampling.

3. DOSE ASSESSMENT

3.1 DESCRIPTION OF DOSE MODEL

CAP88-PC Version 3.0, a computer program approved by U.S EPA for compliance with 40 CFR Part 61 Subpart H, was used to calculate the dose from DOE radionuclide emissions to air. The program uses a modified Gaussian plume equation to estimate the dispersion of radionuclides. The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area.

3.2 SUMMARY OF INPUT PARAMETERS

Input parameters for the CAP88-PC model include physical parameters for each radionuclide emission source, radionuclide emissions, meteorological data, and agricultural data. Table 2 (Section 2.) provides the radionuclide emissions for each source. Default values were used for the size and class of each radionuclide. Table 8 provides the physical parameters for each source.

Table 8. Physical Parameters for DOE Air Emission Sources

Parameter	X-326[a]	X-622[b]	X-623	X-624	X-627	DUF_6 facility
Stack height (m)	22	8.1	7.6	6.1	6	21.95
Stack diameter (m)	0.36	0.3	0.2	0.2	0.2	1.07
Exit velocity (m/sec)	6.35	2.9	15.5	20.6	11	17.4

Parameter	Group 1	Group 2	Group 3
Stack height (m)	50	20	14
Stack diameter (m)	0.25	0.36	1.5
Exit velocity (m/sec)	18	0.3	12.3

[a] This includes only the X-326 Glove Box
[b] The two emission points at the X-622 (air stripper and clarifier) are modeled as one source.

Site-specific meteorological data were used in the CAP88-PC model. The following data were collected for calendar year 2011:

Annual precipitation:	137 cm/year
Average air temperature:	13 °C
Average mixing layer height:	529 meters

Precipitation was measured by an automated gauge near the on-site meteorological tower, which is backed-up by an automated gauge at the X-230L North Holding Pond. The location of the on-site meteorological tower is shown on Figure 1. Air temperature was measured at the on-site meteorological tower. The wind files used in the CAP88-PC model were generated from data collected at the 30-meter and 60-meter heights from the on-site meteorological tower. Wind roses showing the prevailing wind directions for calendar year 2011 are shown below in Figure 1 (30-meter height) and Figure 2 (60-meter height). The wind roses show that the wind blew primarily from the South and Southwest directions in calendar year 2011.

It should be noted that the default values provided with the CAP88-PC model can be very conservative. The rural food array used to estimate the DOE PORTS dose assumes that the public obtains all foodstuffs within 50 miles of the plant (see Table 9). In reality, the majority of the foodstuffs consumed locally are purchased at supermarkets that receive foodstuffs from all over the world.

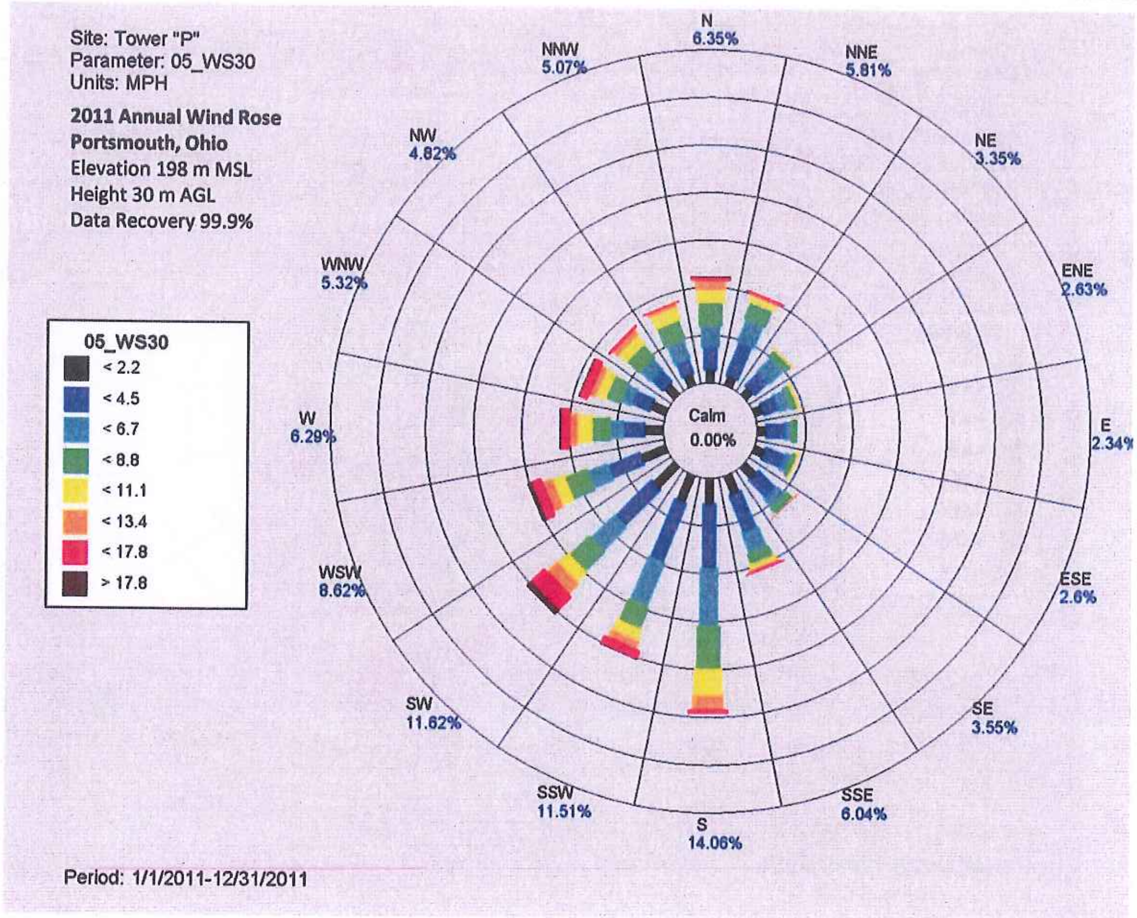

Figure 1 CY 2011 PORTS Wind Rose for 30-meter Height

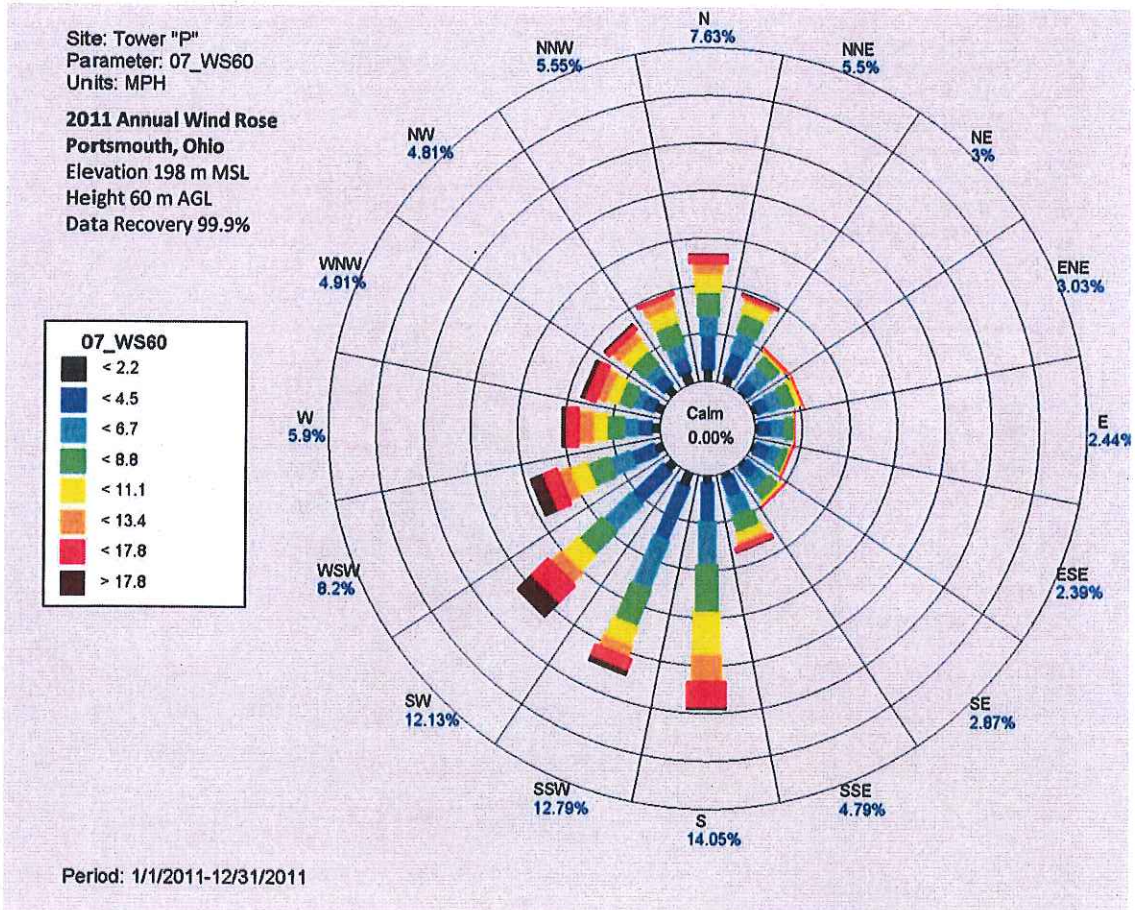

Figure 2 CY 2011 PORTS Wind Rose for 60-meter Height

Table 9. Agricultural Data: Rural Default Food Array Values

Fraction of Foodstuffs	Local Area	Within 50 Miles	Beyond 50 Miles
Vegetables and produce	0.700	0.300	0.000
Meat	0.442	0.558	0.000
Milk	0.399	0.601	0.000

3.3 RESULTS

The CAP88-PC model estimated the 2011 maximum effective dose for the maximally exposed individual (MEI) near PORTS based on emissions from DOE sources to be 0.032 mrem/year. This effective dose includes dose contributions from all of the radionuclides listed in Table 2.

The effective dose to individuals based on USEC, Inc. emissions has been combined with the DOE effective dose. In 2011, the maximum effective dose for USEC, Inc. was 0.0000026 mrem/year, as provided to DOE by USEC, Inc. DOE is not certifying the USEC, Inc. data. DOE understands that the USEC, Inc. PORTS NESHAP report will be provided to U.S. EPA by USEC, Inc. and will be certified by USEC, Inc.

The DOE effective dose is combined with the USEC, Inc. effective dose to determine a total effective dose from the PORTS facility. The highest combined effective dose value is the maximum effective dose to the MEI (see Table 10). In 2011, the maximum effective dose to the MEI is 0.032 mrem/year (0.032 mrem/year from DOE sources + 0.0000017 mrem/year from USEC, Inc. sources), which is well below the NESHAP standard of 10 mrem/year.

Table 10. Summary of the CAP88-PC Model Effective Dose (mrem/year) to the DOE, USEC, and Combined MEIs in 2011

	Location [distance (meters), Direction, and DOE Source]	Dose from DOE Sources	Dose from USEC Sources	Combined Dose
DOE MEI location and maximum combined MEI location (DOE + USEC, Inc.)	2301 NE of X-622 1067 ENE of X-623 640 E of X-624 1634 E of X-627 2215 NE of X-326 Glove Box 2250 NE of Group 1 vents 1960 ESE of Group 2 vents 1580 ENE of Group 3 vents 2400 ENE of DUF_6 facility	0.032	0.0000017	0.032
USEC, Inc. MEI location	1346 SSW of X-622 2819 SSW of X-623 3200 SSW of X-624 2582 SSW of X-627 1615 SSW of X-326 Glove Box 1490 SSW of Group 1 vents 3010 S of Group 2 vents 2530 SSW of Group 3 vents 2200 S of DUF_6 facility	0.024	0.0000026	0.024

4. ADDITIONAL INFORMATION

4.1 NEW/MODIFIED SOURCES

In 2011, no new DOE construction or modification activities were conducted per 40 CFR 61.96.

4.2 UNPLANNED RELEASES

There were no unplanned releases of radionuclides during 2011.

4.3 DOSE CALCULATIONS FOR EVALUATION OF DIFFUSE/FUGITIVE EMISSIONS

Ambient air monitoring stations (see Figure 1) measure radionuclides released from the DOE and USEC, Inc. point sources (see Table 2 and Table 5), fugitive air emission sources such as those discussed in Section 2.3, and background levels of radionuclides. Samples are collected weekly from 15 stations and composited monthly. Analyses for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240) are performed quarterly based on the infrequent detections of these radionuclides. Analyses of technetium-99, uranium-233/234, uranium-235, uranium-236, and uranium-238 are performed monthly.

The CAP88-PC model is used to generate a dose conversion factor for each radionuclide. The dose conversion factor is used to compute a dose in mrem/year for a given activity of a radionuclide in air (in picocuries per cubic meter). For radionuclides that were detected in ambient air during 2011, the dose for that radionuclide is calculated by using the maximum activity of each detected radionuclide. For radionuclides that were never detected, the dose is calculated by using half of the highest undetected result to calculate the maximum activity of the radionuclide in air. The doses attributable to each radionuclide are then added to obtain the gross dose for each station. The net dose is obtained by subtracting the dose at station A37, the background monitoring station (the net dose is recorded as zero for stations with a gross dose less than the background station).

Table 11 summarizes the total dose (both gross and net) for each station. The highest net dose for the ambient air monitoring stations was 0.0012 mrem/year at station A9, which is on the southwestern PORTS property boundary.

Table 11. Summary of Doses (mrem/year) at Ambient Air Monitoring Stations in 2011

Station	Gross dose	Net dose	Station	Gross dose	Net dose
A3	1.0E-03	0	A24	1.0E-03	0
A6	1.3E-03	0	A28	1.0E-03	0
A8	1.1E-03	0	A29	1.2E-03	0
A9	2.5E-03	1.2E-03	A36	9.1E-04	0
A10	1.1E-03	0	A37 (bkg)	1.3E-03	-
A12	6.0E-04	0	A41	4.5E-04	0
A15	7.8E-04	0	T7	5.5E-04	0
A23	1.6E-03	3.0E-04			

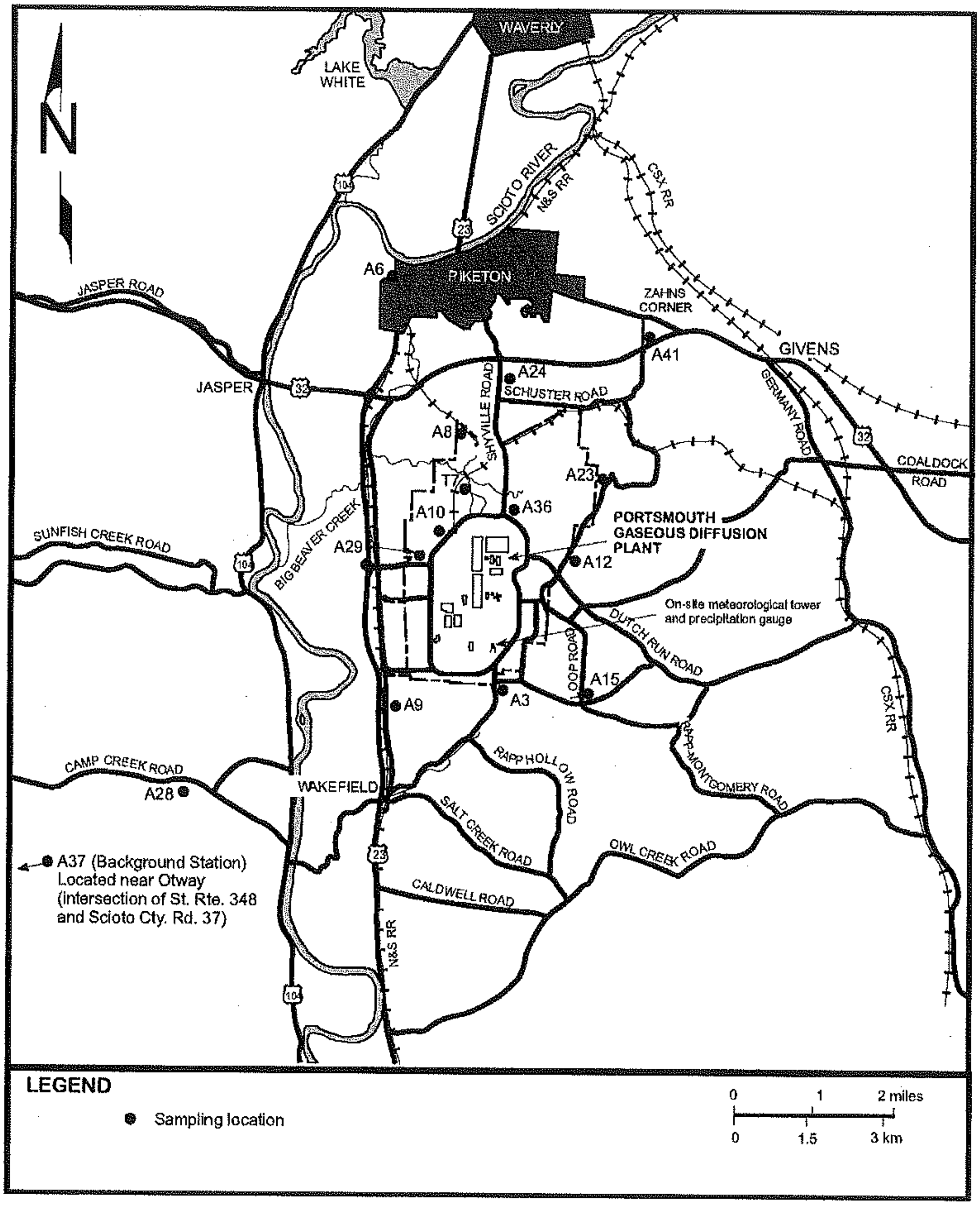

Figure 3. DOE PORTS Ambient Air Monitoring and Onsite Meteorological Monitoring Stations

The highest net dose measured at the ambient air monitoring stations (0.0012 mrem/year) is four percent of the dose calculated from the combined DOE and USEC, Inc. point source emissions (0.032 mrem/year). These results indicate that fugitive and point source emissions of radionuclides from the PORTS reservation do not cause a significant dose to individuals near the site and further demonstrate that emissions of radionuclides from PORTS are well within NESHAP limits.

4.4 DOSE CALCULATIONS FOR SECURITY FENCE LINE LOCATIONS

Per request by U.S. EPA Region 5, a dose calculation using the CAP88-PC model was also completed for locations around the perimeter of the security fence of the PORTS process area (the limited access area). Emissions from the DOE radionuclide sources (the X-326 Top and Side Purge Cascades, X-326 and X-330 Seal Exhaust Stations, X-330 Cold Recovery System, X-330 Building Wet Air Evacuation System, X-344A Cold Trap Area and Manifold Evacuation/Gulper, X-705 Decontamination Facility, Calciners, Glove Boxes, and Storage Tank Vents, X-710 Laboratory Fume Hoods, XT-847 Glove Box, X-326 L-cage Glovebox, X-622, X-623, X-624, and X-627 Groundwater Treatment Facilities, and DUF_6 conversion facility) were used to determine the dose to a hypothetical person living at the fence line for the limited access area at each of the 16 directional sectors around the plant (i.e., north, north-northeast, northeast, east-northeast, etc.). The maximum dose a hypothetical person living at the PORTS security fence line would receive from DOE radionuclide emissions is 0.15 mrem/year at the south-southeast sector of the security fence line for the limited access area.

4.5 REFERENCES

DOE 1995. *Performance Test Report X-735 Landfill Closure (Northern Portion) Cap Construction and Gas Venting System*, DOE/OR/11-1420&D1, POEF-ER-4626&D1. Lockheed Martin Energy Systems, Piketon, Ohio.

Sampling, Analysis and Quality Assurance Plan for the Portsmouth Gaseous Diffusion Plant Ambient Air Monitoring Program, LPP-0086.

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